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Research Paper

STRESS ANALYSIS SPUR GEAR DESIGN BY USING ANSYS WORKBENCH

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A gear is a rotating machine part having cut tooth, which mesh with another toothed part in order to transmit torque. Gears are mainly type like spur gears, helical gears, double helical gears, bevel gears, crown gears, hypoid gears, worm gears, rack and pinion, epicyclic gears etc. The application of these gears fled from tiny wrist watches to huge machinery equipment gears from vital elements of mechanism in many machines such as automobile, aerospace industry, rolling mills, hoisting and transmitting machinery, marine engines, and the like. Parallel and co-planer shaft connected by gears are known as spur gear. Spur gear have straight tooth and are parallel to the axis of the wheel. Spur gears are most common type of gears. A pair of spur gear tooth in action is generally subjected to two types of cyclic stress: contact stress and bending stress including bending fatigue. Both stress may not attain their maximum values at the same point of contact fatigue. These types of failure can be minimized by analysis of the problem during the design stage and creating proper tooth surface profile with proper manufacturing methods. In this paper using ansys work bench software, bending stress, contact stress and static load on the tooth of spur gear drive is found.

Keywords: Bending stress, Contact stress, Gear analysis using, Ansys work bench, Static load

INTRODUCTION

Due to globalization industries are facing competition. It becomes more and necessary to consider alternative technology of manufacturing materials used for gears (Meenakshi *et al.*, 2012).

The high volume production industry such as automobile industry has various manufacturing materials used gears like metal removal method, casting and forming method, but that method which is more suitable containing finishing operations optimal utilization of raw materials, short-cycle times and favorable energy consumptions, compared to convectional manufacturing technology (Rattan, 1998).

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Now days, there are so many mechanisms those involve with load and requirement to understand the stress in component is increased. The mechanisms and the stress always come together and they have a strong relation between each other (Romlay, 2008).

Gears is a rotating cylindrical wheel having tooth cut on it and which meshes with another toothed part to transmit the power or torque. Spur gear is the simplest type of gear having at tooth cut parallel to the axis of shaft on which the gear is mounted. Spur gears are used to transmit the power between parallel shafts. Spur gear give 98-99% operating efficiency (Vivek Karaveer *et al.*, 2013).

There are several kinds of stresses present in loaded and rotating gear teeth. We have to consider all the possibilities, so that the gears are proportional to keep all the stresses with in design limit. Generally stresses calculated in gear design formula are not necessary true stress, can make it difficult to get correct answer on gear-tooth stresses, because it may not be known whether load is uniformly distributed across the face width and whether properly shared by the two or more pairs of teeth that are in mesh at the same time. So we have to make right assumption that will allow for things like stress concentration, residual stress, misalignment and tooth error (Sushil Kumar Tiwari and Upendra Kumar Joshi, 2012).

There are two theoretical formulas, which deal with these two fatigue failure mechanism. One is the Hertz equation, which can be used to calculate the bending stress (Shinde *et al.*, 2012).

The finite element method is capable of providing this information but it is time taken, the time need to create such a model is large. In order to reduce the modeling software can be used. One such model is provided by ansys work bench.

FINITE ELEMENT METHOD

The finite element method is numerical analysis technical of optioning approximate solution to a wide verity of engineering problems. because of its diversity and flexibility as an analysis tool, it is receiving much attention in engineering school and industries in more and more engineering situation today, we find that it is necessary to obtain approximate solution to problems rather than exact close from solution it is not possible to obtain analytical mathematical solutions are many engineering's problems. An analytical solution is a mathematical expression that gives value of the desire unknown quantity an any location in the body, as consequence it is valid for infinite number of location in the body. For problem involving complex material properties and bounder condition, the engineer resource to numerical method that provide approximate that eatable solution.

METHODOLOGY

Procedure of Static Analysis

First of all, we have prepared assembly in Pro/E for spur gear and save as this part as IGES for Exporting into ANSYS workbench Environment. Import IGES mode in ANSYS workbench simulation module. Apply material for spur gear (structural steel).

Meshing Criteria

Element type solid 10 node quadratic tetrahedral.

Figure 1: Part Design of Spur Gear

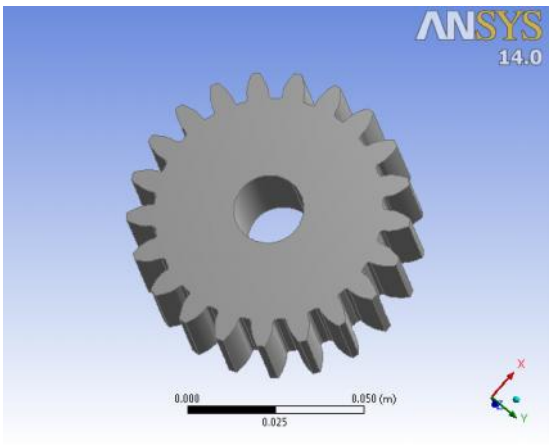


Figure 2: Mess of the Gear

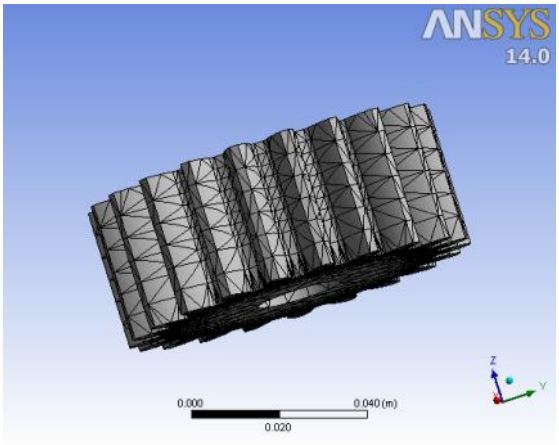


Figure 3: Shear Stresses

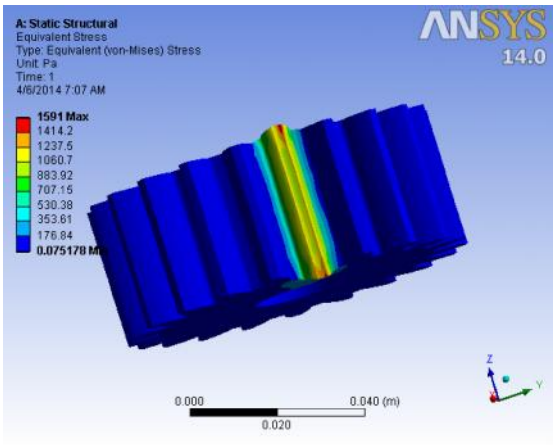


Figure 4: Directional Deformation

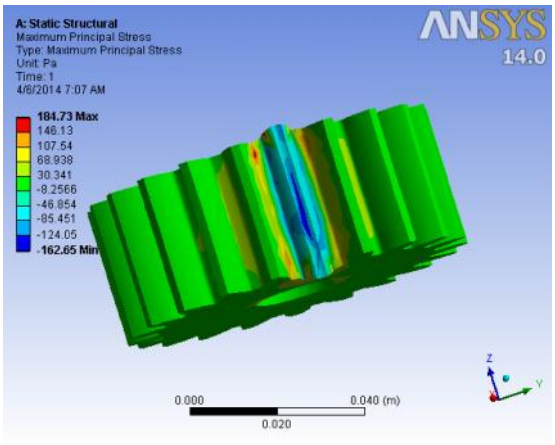


Figure 5: Middle Principal Stress

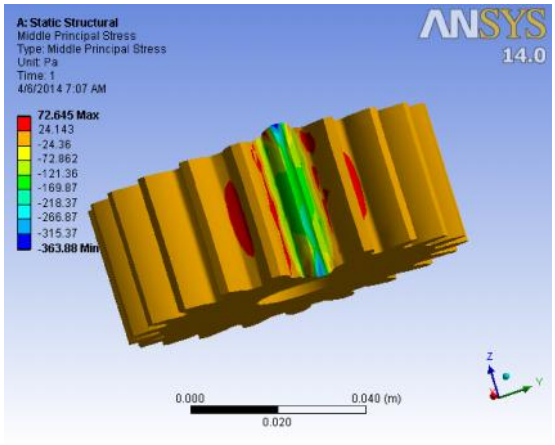


Figure 6: Minimum Principal Stress

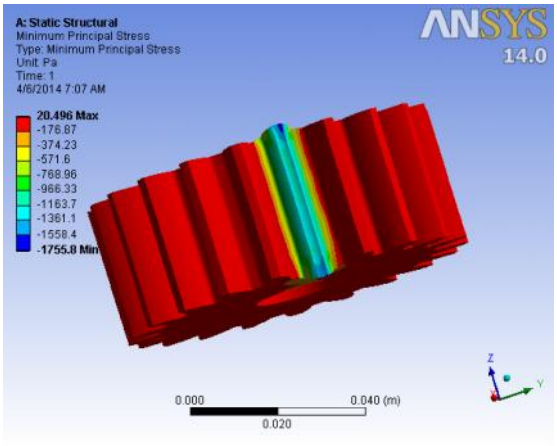


Figure 7: Stress Intensity

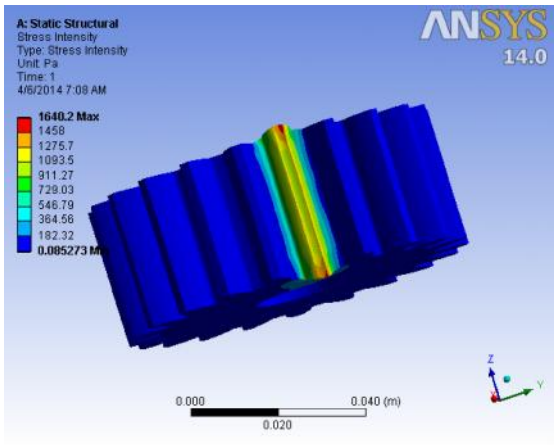
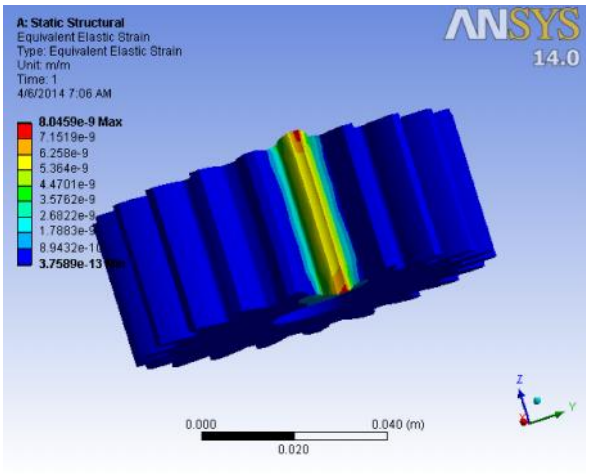


Figure 8: Middle Principal Elastic Strain of the Crankshaft



Define Boundary Condition for Analysis

Boundary condition play the important role in finite element calculation here, I have taken both remote displacement for bearing supports are fixed.

CONCLUSION

The finite element method is most widely for find a real model of the geared set using the stress analysis in the pair of gears. The development off finite element analysis model of the spur gear assembly to simulate the contact stress calculation and bending stress calculation is play more significant role in the design of gears. The study is show that Hertz theory is the basis of contact stress calculation and Lewis formula is use for calculating bending stress is a pair of gear. Theoretically result obtained by Lewis formula and hertz equation and result found by comparable with finite element analysis of spur gear.

As a result, based on this finding if the contact stress minimization in the primary concern and if the large power is to be transmitted then spur gears with higher model is preferred. Hence we conclude that analysis software can be used for other analyzing purpose.

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